Nature's Coast Guard:

Valuing and Financing Mangrove Conservation in the Indo-Pacific

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Abstract

The Indo-Pacific, which holds most of the world's mangroves, faces serious risks from natural disasters, including those related to the long-term sustainability of coastal communities and valuable ecosystems. Mangroves uphold biodiversity, support ecosystem functionality, and sustain local livelihoods; however, financing their conservation is proving to be a massive challenge. This report examines the ecosystem services provided by mangroves, identifies the associated challenges in conservation, and recommends possible financing pathways by public development banks and the private sector undergirded by a collaborative and cooperative framework. The report also attempts to identify gaps in existing financing in the conservation and restoration of mangroves and discusses novel financing instruments, paving the way for institutional changes to shape the sustainability narrative.

This report is based on discussions and insights shared by experts during a one-day hybrid workshop on "Mangrove Symphony: Blending Blue Carbon, Climate Resilience & Sustainable Finance in the Indo-Pacific", held under the auspices of the SUFIP Development Network in November 2023 and organised by ORF Kolkata.

Introduction: Mangroves, Climate Change, and Development Finance

Mangroves are complex ecosystems that are predominantly found in the world's tropical and subtropical regions. They are assemblages of trees (including shrubs, creepers, ferns, and palms) that exist at the interface of salt and water near coastlines, shores, and river banks,[1] abundant in places where freshwater mixes with seawater and where sediment is composed of accumulated deposits of mud. These habitats also contribute to both climate adaptation and mitigation efforts. Further, mangrove ecosystems offer societal, economic, and ecological benefits amid climate-induced disasters, especially cyclones and frequent storm surges.[2] Given their distinct functionalities, structure, and productivity, indigenous communities are able to rely on these forests for different purposes.[3]

Mangroves provide important ecosystem services[a,4] and play an important role in regulating the coastal ecosystem and the global climate.[5] They act as nurseries and feeding grounds for a wide variety of species, including fishes and crustaceans, provide a buffer against storms, and operate as carbon sinks. They also offer livelihood and economic opportunities to the poor in coastal regions, including those related to wood and non-wood forest products, as well as environmental benefits such as coastal hazard protection, erosion control, water filtration, and biodiversity conservation.

Human communities that live in and around mangroves rely heavily on these ecosystem services. Yet, the impacts of climate change on the structure, functions, and services of the ecosystem have received little attention in global climate negotiations.[6]

Mangroves absorb and store carbon dioxide, thereby contributing to the global blue-carbon sink. This carbon sequestration function of mangroves, as well as other coastal ecosystems like seagrasses and salt marshes, is important in mitigation efforts.

Anthropogenic interventions as well as global warming and climate change have resulted in a substantial degradation in the ecosystem health of this critical carbon sink.[7] Over the last five decades, 20-35 percent of mangroves have become extinct.[8] This is primarily due to land-use change from rapid urbanisation and the conversion of mangroves for agriculture, aquaculture, and coastal development.[9] Large-scale physical infrastructure development, which involves land-use change, has altered nutrient, sediment, and water supplies and has led to the degradation and loss of ecosystem services.

From a climate action perspective, mangrove ecosystems aid both mitigation and adaptation. They offer a "nature-based solution" towards climate mitigation through carbon sequestration. They support adaptation, meanwhile, by acting as a shield and buffer to protect surrounding human communities from extreme events like cyclonic storms and storm surges, thereby enhancing resilience.[10]

Mangrove loss also impacts the macroeconomy; mangroves affect the fundamental factors of production through various ecosystem services, which are often not accounted for, nor even acknowledged, in the formal market framework.

a Goods and services provided by the natural ecosystem to the human community through organic functioning.

Therefore, financial support and investments in blue carbon[b] initiatives need to take into consideration the causes of mangrove loss, with the aim of preserving their role in sequestering carbon and maintaining healthy ecosystems.[11]

The mangroves of the Indo-Pacific face the serious risk of extinction; this, in turn, poses a threat to the long-term sustainability of coastal communities and valuable ecosystems. Mangroves in the Indo-Pacific continue to be converted for other land uses. Amid the challenges, sustainable financing for their protection has not been forthcoming due to limited-length project cycles, the lack of established Payment for Ecosystem Service (PES) schemes covering mangroves, unclear tenure in many mangrove areas, and the limited size of mangrove areas in relation to the economies of scale necessary to offset costs associated with accessing carbon payments.

The Western Indo-Pacific has two mangrove hotspots that have distinct habitat types: fringe mangroves in the Coral Triangle (encompassing central and eastern Indonesia, the Philippines, Papua New Guinea, and Melanesia) and riverine mangroves in the Strait of Malacca, between the west coast of Peninsular Malaysia and Indonesia's Sumatra. Mangroves that grow upstream, along rivers and shores at high tide, are typically at greater risk of habitat loss than fringe mangroves, as the former are often situated near human settlements and the first to be cleared for timber and oil palm plantations as well as for aquaculture ponds.[12] Moreover, mangrove conservation has largely focused on reducing the decline in mangrove forest cover. There is need for increased focus on protecting the diversity of mangrove plants and species that are considered to be at risk according to the IUCN Red List[c] and maintaining the ecosystem services provided by mangroves.

Sea-level rise can threaten the long-term sustainability of coastal communities and valuable ecosystems such as coral reefs, salt marshes, and mangroves. Mangrove forests have the capacity to keep pace with sea-level rise and prevent flooding through the vertical deposition of sediments, which allows them to maintain wetland soil elevations suitable for plant growth. However, sediment delivery in the Indo-Pacific region is declining due to anthropogenic activities such as the damming of rivers. This decline is particularly concerning because this region is expected to have variable, but high, rates of future sea-level rise.[13]

b 'Blue carbon' refers to the carbon stored in the world's marine and coastal ecosystem.

c As per the global assessment by the International Union for Conservation of Nature (IUCN), 50 percent of the world's mangrove ecosystems are at risk of collapse.

In the Indian subcontinent, the Sundarbans Delta, spread across Bangladesh and the state of West Bengal in India, is a prominent example of a mangrove ecosystem that is co-habited by humans and wildlife. The Indian part of the delta, which consists of diverse species of aquatic and terrestrial flora and fauna, is facing the threat of extinction. Over the last three decades, soil erosion alone has resulted in the loss of about 24.55 percent of mangroves (more than 136 square km) in this region.[14] Other challenges include rising temperatures, sea level rise, increasing frequency of high-intensity cyclonic events, deforestation, loss of sediments, and increasing saline water intrusion. Saline water intrusion and land loss have made agriculture unviable in a region where a majority of the population is dependent on subsistence agriculture. In the absence of local employment opportunities, there has been large-scale outmigration to other regions in search of livelihoods. Additionally, the region is experiencing serious issues of malnutrition, uneven land ownership, and limited income-generating options.[15]

> In climate action, mangroves aid both mitigation and adaptation. Over the last 50 years, a third of the world's mangroves have become extinct, primarily due to rapid urbanisation and land-use conversion.

Valuing Mangroves: The Imperative

The value of environmental and natural resources emerges from the ecosystem services they provide to human communities. Ecosystem services highlight the importance of preserving natural habitats and biodiversity for human well-being. The various types of services that are offered by mangroves are one of their essential ecological functions and have long-term economic implications through benefits[d] for fisheries and other purposes (see Table 1).[16]

d The *Millennium Ecosystem Assessment 2005* examined the consequences of ecosystem change on human well-being. As per the report, ecosystem services are the benefits gained by people from the ecosystem, which can be classified in four major categories: provisioning (like food and water), regulating (such as carbon sequestration and climate regulation), supporting (soil formation and nutrient cycling), and cultural (spiritual and recreational benefits including tourism). However, in 2011, the Economics of Ecology and Biodiversity (TEEB) revised this classification and replaced "supporting services" with "habitat services" and "ecosystem functions". These two subsets focus on the interactions between the ecosystem structure and processes that bolster the capacity of an ecosystem to render goods and services.

Table 1: Classification of Ecosystem Services

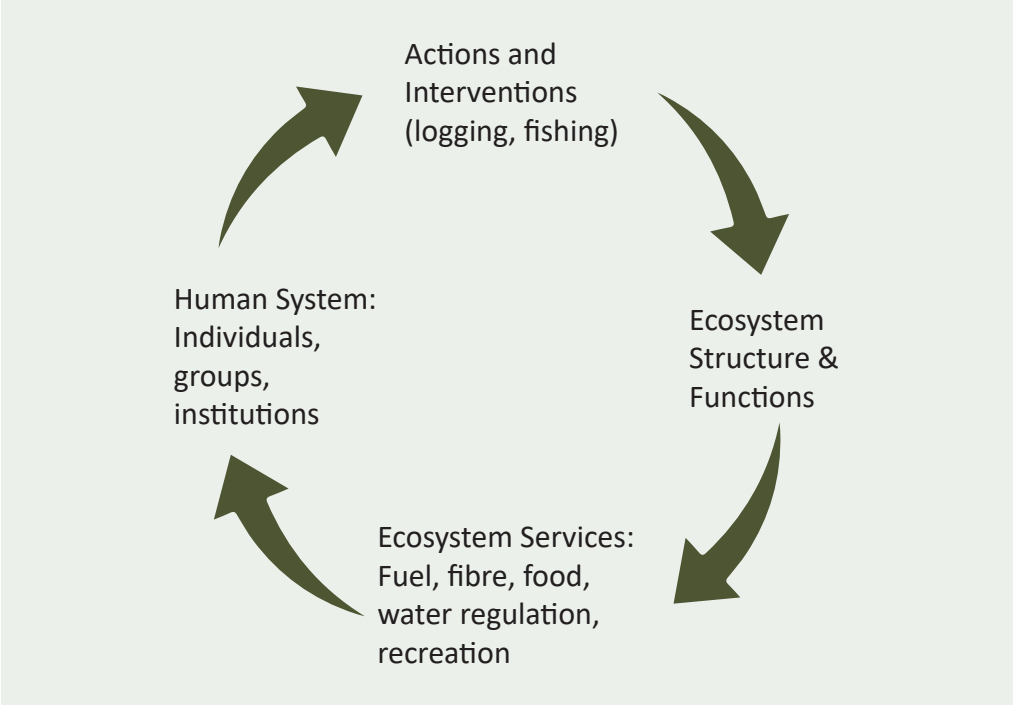
Ecosystem Service Class	Definition/Description	Examples
Provisioning services	Ecosystem services that describe the material or energy outputs from ecosystems.	Cultivated plants for nutritional purposes, raw materials like wood, and fresh water
Regulating services	Services provided by the ecosystems by acting as regulators, e.g., regulating the quality of air and soil or by providing flood and disease control.	Air and water quality regulation, moderation of extreme events like flooding, storm surge protection, carbon sequestration, pollination and natural pest control
Cultural services	The non-material benefits people obtain from ecosystems.	Recreation possibilities, tourism, and aesthetic appreciation of the natural environment
Supporting services	Services that support the above three ecosystem services.	Soil formation, nutrient cycling, and primary production.

Source: Millennium Ecosystem Assessment[17]

Literature on the interlinkages between the ecosystem and the economy can be traced to the Club of Rome's *The Limits to Growth* report.[e,18] While the neo-Malthusian thesis of the report emphasised the irreconcilable trade-off between development and environment, recent discourses on sustainability, especially its more complete statement in the form of the Sustainable Development Goals,[19] acknowledge that biodiversity conservation is not contrary to development, and that a bi-directional causality exists between ecosystem and economy[20] (see Figure 1). The economic forces and actions that are part of the human social system act as interventions in the ecosystem to fulfil economic needs. In this context, actions pertain to economic activities, which extract ecosystem services while acting as interventions on the ecosystem structure and functions.

e The core hypothesis of the volume is largely neo-Malthusian: indiscriminate use of natural resources will lead to the degradation and destruction of the natural capital base, which will be a limiting factor for future growth. It also emphasised the importance of imposing limits on consumption to maintain the equilibrium between global population and production.

Figure 1: The Economy-Ecosystem Linkage



Source: Resilience Alliance[21]

Since ecosystem services are incorrectly considered to be "abundant" and "accessible" despite the lack of property rights definitions, markets are hardly formed and inevitably do not fetch prices. Therefore, in the absence of a market framework, ecosystem services are not valued and acknowledged, which results in the ecosystem being subject to exploitation and misuse, resulting in long-term environmental degradation and depletion. Valuation of ecosystem services would allow the human community to understand the role of the ecosystem in providing critical services, which would otherwise be lost to overexploitation. The valuation of ecosystem services can also facilitate the optimisation of investments towards biodiversity and channel them in a sustainable manner.[22]

There are claims that the monetary valuation of ecosystem services would result in the commodification of nature.[23] While not everything can be understood in terms of monetary metrics,[24] there is widespread agreement that the valuation of non-marketed goods and services offered by the ecosystem has opened up new avenues for analysing the global economic development landscape. For example, as per estimates of the World Economic Forum, about

US$44 trillion of economic value generation, which accounts for over half the world's total GDP, is moderately or highly dependent on services from nature,[25] with construction (US$4 trillion), agriculture (US$2.5 trillion), and food and beverages (US$1.4 trillion) being the three largest industries that depend on nature.[26] These industries rely on either the direct extraction of resources from forests and oceans or the provision of ecosystem services such as healthy soil, clean water, pollination, and a stable climate. Therefore, loss of natural resources poses a long-term economic risk.

While the valuation of ecosystem services is highly contextual, it has several benefits:

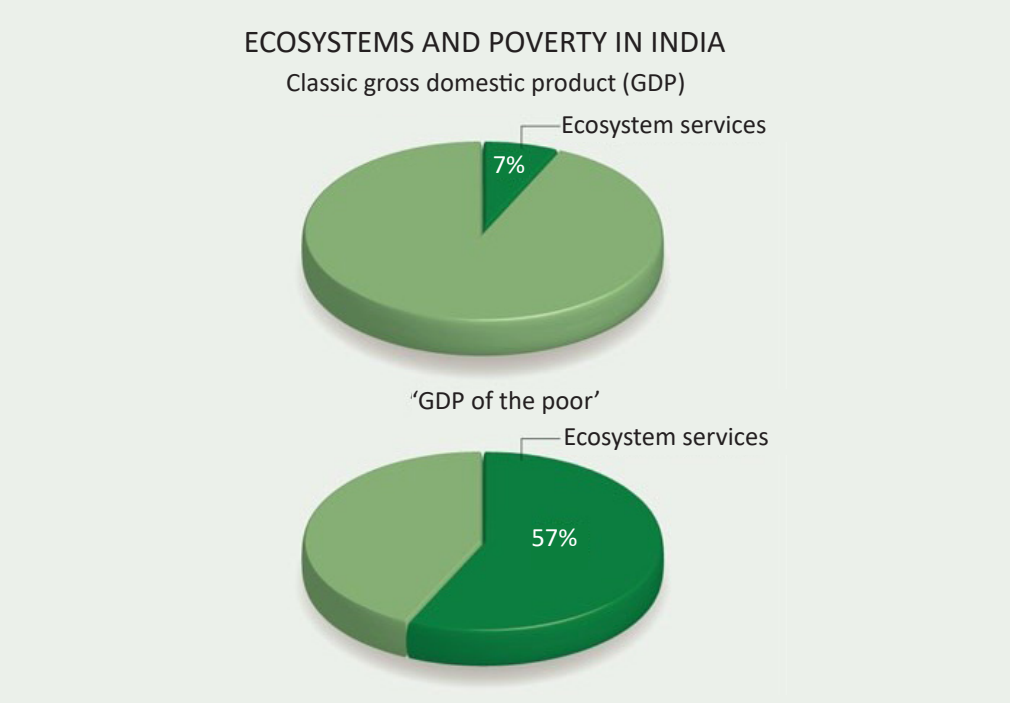
- Offers a basis for understanding the role of the ecosystem in the livelihood and sustenance of the human community at various scales
- Has the ability to guide legal proceedings for determining damages when a party is held liable for the loss to another party
- Helps revise investment (infrastructure development) decisions
- Reduces market failures and enhances the scope for market creation
- Helps in improved appreciation of conservation programs that are implemented for safeguarding various components of the ecosystem

Moreover, the standard method of evaluating GDP may not be an accurate measure of economic growth or provide a measure of overall societal well-being.[27] The real economy includes natural capital assets—i.e., natural resources that do not have to be produced—and the valuable but non-marketed, ecosystem services that these assets provide, such as the mangroves. In this context, the "GDP of the poor" is relevant as a measure of the value of ecosystem services, since the poor are more dependent on ecosystem services than the wealthy (see Figure 2).

The "GDP of the poor" comprises the composite values of ecosystem services, which are sources of livelihoods for the poor and are overlooked by standard GDP figures. Conversely, the standard GDP definition does not account for the losses in ecosystem services that may have an impact on the economy through existing value chains. Given the high degree of dependence of the

poor on ecosystem services, they are also the most affected by the depletion and degradation of the natural resource base that provides these services.[28] Therefore, the contribution of natural resources and ecosystem services to livelihoods and well-being should be estimated and recognised through a "GDP of the poor", which would encompass the various natural sources that contribute to a the livelihood of the poor in the developing world, including land, freshwater, soil, biodiversity, and marine resources.

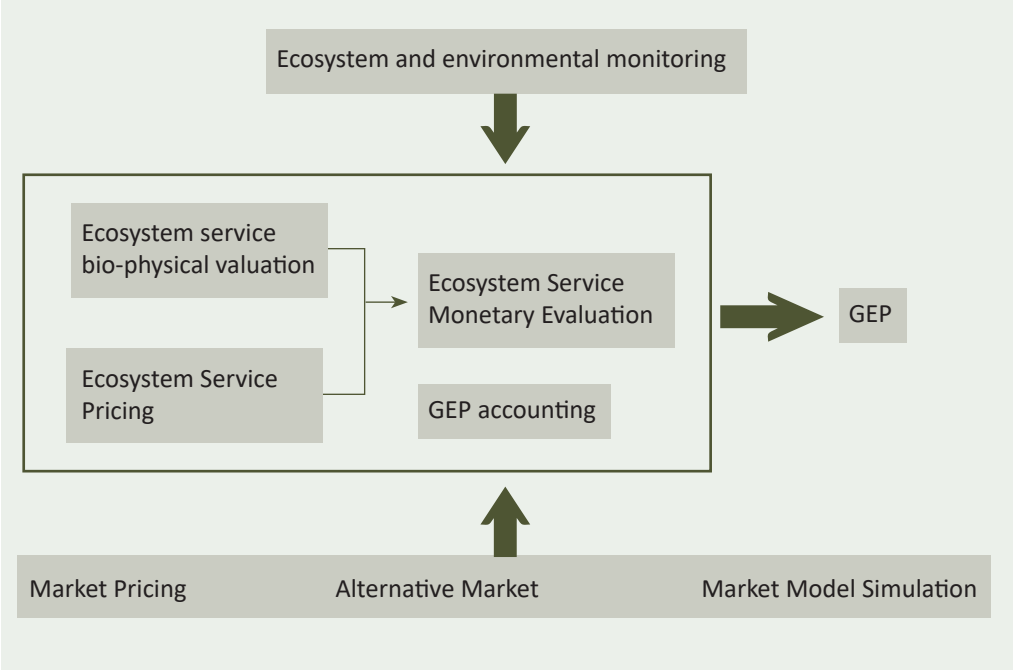
Figure 2: Ecosystems and Poverty in India



Source: Sukhdev, 2009[29]

As an alternative to GDP, a group of researchers devised the Gross Ecosystem Product (GEP),[30] which is a process of pricing ecosystem goods and services such as crop yield, water availability, and ecotourism in order to translate their biophysical value into monetary terms (Figure 3).

Figure 3: GEP and Its Accounting Methods



Source: Zhiyun et al.[31]

Valuation of the Ecosystem Services of Mangroves

Valuation exercises reflect the range of values associated with the ecosystem services of mangroves. Table 2 reflects this range of values, normalised to account for different years, currencies, and the sizes of the mangrove forest.[32] On average, as per 2018 prices, the value of the ecosystem services of mangrove forests amounts to about US$21,100/ha.[33] From a theoretical perspective, it is critical to integrate discussions around the preservation of mangroves in the larger development debate. This can allow for potentially circumventing excessive and mindless growth impacting ecological balance.

Table 2: Values of Ecosystem Services of Mangrove Forests

Variables		Unit of Measurement	Mean	Std.Dev.	Min.	Max.	Observations
Values of the ecosystem services (ES) of the respective mangrove forest							
All ES values (full sample)		USD/ha.a, 2018 prices	21,071.81	132,705.50	0.52	1,432,142.00	250
Values of ES in regard to the type of ES	Provisioning		4897.79	16,951.90	0.52	154,645.60	105
	Regulating		36,100.91	172,911.19	1.28	1,395,925.74	74
	Supporting		401.68	739.27	7.92	3183.11	29
	Cultural		49,299.21	225,375.70	0.69	1,432,142.00	42
Values of ES in regard to the valuation method	Market prices		9008.47	41,333.01	0.52	464,431.50	178
	Replacement costs		93,370.69	329,606.64	6.07	1,395,925.74	18
	Travel costs		94,164.08	324,040.33	12.44	1,432,142.00	20
	Willingness-to-pay		2955.58	9139.77	3.46	41,394.37	34
Values of ES of mangrove forests that are protected			17,718.40	114,638.46	0.52	1,432,142.00	184
Gross domestic product (GDP)		USD (per capita, 2018 prices)	5366.77	6290.09	490	41,464.00	66
Population (POP)		Residents (million)	200.65	314.54	0.25	1414.05	66
Size of the mangrove forest (SIZE)		Hectares (ha)	57,158.98	174,601.16	2	770,000.00	66

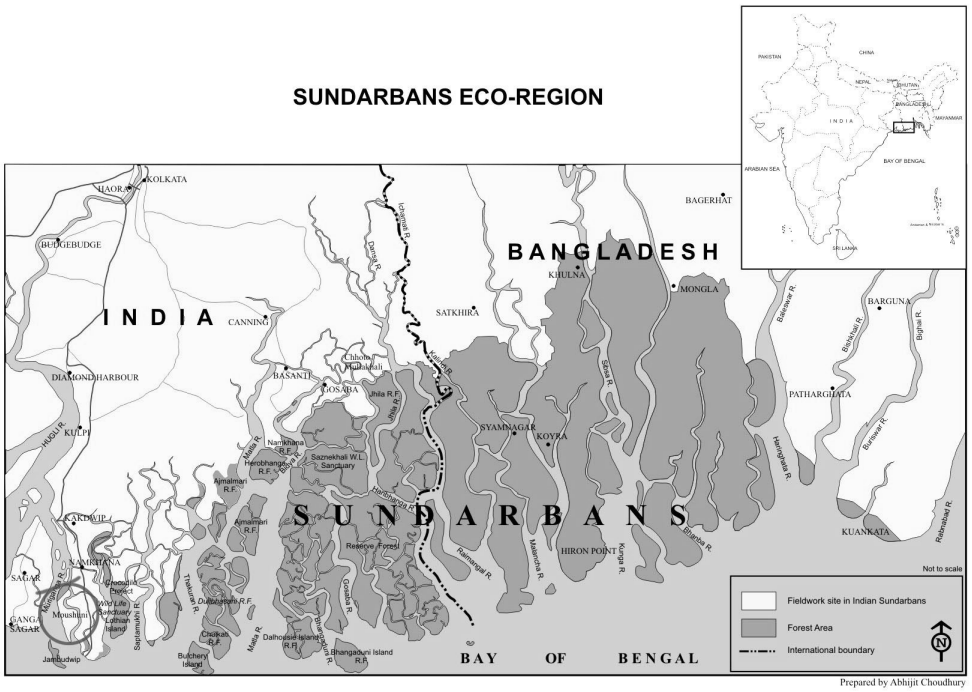
Source: Getzner and Islam (2020)[34]

Valuation of Mangroves: A Case Study of the Sundarbans

The WWF Vision 2050 case study, conducted by Ghosh et al.,[35] highlights the importance of the ecosystem service valuation of mangroves from adaptation, mitigation, and development decision-making and policymaking perspectives. According to the WWF Vision 2050, a long-term strategy for adaptation has been proposed for the Indian section of the Sundarbans delta. This strategy was proposed to be undertaken in the form of a planned retreat of populations from the vulnerable zone of the delta by the year 2050.[36]

With life and livelihoods in the Indian Sundarbans (ISD) considered to be unsustainable, the strategy vision proposed by WWF India entailed a strategic retreat of the vulnerable population from the climatically vulnerable zone and the regeneration of mangrove forests in the vulnerable zone. The strategy is driven by the belief that a safer habitat and proper sources of livelihood will uplift the quality of life and result in subsequent mangrove restoration in the vulnerable zone, which will, in turn, yield ecosystem benefits in the forms of provisioning services as well as regulating services such as storm protection and carbon sequestration.

Figure 4: Map of the Sundarbans Eco-Region



Source: Ghosh, 2018[37]

Whether such a strategic retreat with a mangrove regeneration project entailing both adaptation and mitigation yields more benefits compared to a business-as-usual (BAU) scenario needs to be answered through a comprehensive cost-benefit analysis that also involves the valuation of ecosystem services. The BAU scenario is one in which the community does not relocate by 2050. Assuming a base-case economic and development condition between 2050 and 2100 being affected by natural disasters, it was found that, between the years 2050 and 2100, the total value that will be yielded by the vulnerable regional economy in the ISD would reach INR 172.31 trillion.[38]

On the other hand, the Vision 2050 scenario entails a strategic retreat or organic outmigration of the population to a stable and developed region that is earmarked for the movement, and simultaneous regeneration of mangroves in the vacated region. While costs will be incurred for various capital expenditures as well as operations and maintenance costs, including building infrastructure, re-skilling, mangrove restoration, and corpus creation, there will be potential benefits in the form of incomes from alternative employment, eco-tourism, ecosystem services of mangroves, and access to the regenerated mangrove forest.

Table 3 shows the valuation of a few ecosystem services from regenerated mangroves, calculated using standard valuation methods such as surrogate pricing, indirect values, and benefit transfer.

Table 3: Value of Flows of Ecosystem Services (2050 to 2100, in INR Billion)

Ecosystem Service	Current Value of Flows of Benefits
Carbon Sequestration	695,380.66
Fishery Production	84,621.69
Storm protection	327,033.43
Tourism Benefits	54.89
Fuel Wood	19,778.68
Honey	23,808.79
Prawn Larvae	10,023.39
Crab	45,836.02
Total	1,206,537.55

Source: Ghosh et al. (2016)[39]

Incomes will also be generated through employment in the service sector and through skilled employment. These figures have been estimated on the basis of field data and necessary wholesale price index (WPI) adjustments. The net benefit flows comprise the total value of the flow of economic and the ecosystem benefits generated from 2050 to 2100, the total value of the flow of incomes from employment in the services sector, and the total value of the flow of incomes from skilled employment.

Table 4: Vision 2050 Scenario: Statement of Flows of Benefits and Costs (2050 to 2100)

Benefits	INR Billion
Total Value of Ecosystem Services (a)	1,206,537.55
Total Income Generated out of Service Sector Employment (b)	460,781.74
Total Incomes from Skilled Employment (c)	726,457.70
Total Flows of Benefits from 2050 to 2100 (A= (a)+(b)+(c))	2,393,776.98
Costs	
Total Cost for Mangrove Regeneration (d)	91.02
Loss in Incomes from BAU Scenario (e)	172,306.27
Total Cost of Residential Constructions (f)	2,024.89
Cost of Establishing Three Hospitals (g)	123.43
Cost of Establishing Five Secondary Schools (h)	6.17
Cost of IT Training Institute (i)	4.11
Cost of ITI (j)	4.11
Corpus (k)	16,457.91
Total Flows of Costs (including sunk costs) from 2050 to 2100 (B = sum(d) to (k))	191,017.92
Flows of Net Benefits from 2050 to 2100 (A-B)	**2,202,759.05**

Source: Ghosh et al. (2016)[40]

Table 5 presents the comparative figures of net benefits across the two scenarios.

Table 5: Current Expected Value of Flow of Net Benefits (2050-2100)

Scenario	Current Value of Net Benefits (INR 000 Billion/Trillion)
Business-as-usual	172.31
Vision 2050	2,202.76

Source: Ghosh et al. (2016)[41]

The current value of the net benefits from the Vision 2050 scenario (INR 2202.7 trillion) is 12.8 times that of the BAU scenario (INR 172.31 trillion) for the period 2050-2100, justifying a decision in favour of Vision 2050. In addition to justifying strategic retreat and mangrove restoration in the Indian Sundarbans delta from an economic standpoint, it creates a framework for ex-ante and ex-post project evaluation for climate adaptation and nature-based mitigation solutions and highlights the importance of mangroves. The applicability of this approach and the framework extends to spaces and situations where the combined value of assets, produce, and services have already fallen or will fall below the cost of protecting the place due to impacts of climate change. This exercise also highlights that the economic valuation of the potential ecosystem services of regenerated mangroves has been integrated into the development planning process in a time-bound manner. The importance of the mangrove ecosystem in human development has also been advocated in the Generic Adaptation Decision Framework (GADF).[42]

The State of Financing for Mangroves in the Indo-Pacific

Mangroves offer both mitigation and adaptation services. The imperative for financing arises from the social cost of carbon (SCC). The SCC provides an estimate of the monetary value of the losses caused by an additional tonne of carbon emissions, thereby highlighting the benefits of mitigating that extra unit of emission. By directly cutting off atmospheric carbon, mitigation actions prevent the escalation of societal and economic costs. On the other hand, adaptation projects reduce the SCC by enhancing human and community-level resilience without reducing atmospheric carbon. Traditional financing mindsets often overlook the social and environmental costs associated with climate change, such as increased risks to public health and safety, damage to infrastructure and property, and impacts on ecosystems and biodiversity, all of which elevate the social cost of carbon. These costs, though significant, are frequently excluded from investment decisions. As such, mangroves offer the ideal nature-based solution for mitigation.

Scaling up the deployment of capital to finance nature-based solutions (NBS) from both public and private sources is essential, including the right mix of economic and regulatory incentives. This requires human ingenuity as well

as the willingness of politicians, business leaders, finance institutions, and consumers to work with nature instead of against it.[43]

NBS can play a crucial role in addressing a broad range of societal challenges, from managing water scarcity to reducing disaster risk to poverty alleviation. The WEF estimates that nature-positive policies could attract more than US$10 trillion in new annual business value and create 395 million jobs by 2030.[44]

However, there have been critical challenges with adaptation financing. UNEP's 2023 Adaptation Gap Report[45] reveals that the gap between the climate adaptation finance needs of developing nations and the actual funds flowing in is rapidly widening, resulting in a 10-18-fold difference, which is over 50 percent greater than previously estimated. Meanwhile, actualising domestic adaptation blueprints requires 360 billion euros each year.[46] MFIs and DFIs have revealed a lopsided financing portfolio, with significant funding biases in favour of mitigation projects, as there is no perceptible return on investment (RoI) in adaptation projects compared to mitigation projects, which results in a perceptible economic rate of return in the short run. Therefore, mangrove regeneration is an NBS that serves the purpose of mitigation as well as adaptation through increasing community resilience, thus reducing disaster risk and improving food and water security. As people and nature are inextricably linked, financing inclusive NBSs that integrate cross-cutting principles such as gender equality and a rights-based approach is crucial.

Several financing opportunities exist for mangrove restoration projects, from grants to market-based instruments.[47]

- **Blue bonds**

A contemporary form of sustainable financing, a blue bond is a debt instrument where countries can opt for loans to support investments for promoting the blue economy. These bonds generate income by investing in projects and initiatives that promote the sustainable use and conservation of marine and coastal resources.

- **Insurance**

Several insurance companies have been supporting ecosystem restoration through policies covering natural disasters, droughts, floods and the resultant damages

caused by such events. Moreover, they have been trying to incentivise traditional insurance holders in coastal areas to invest in nature-based solutions or nature restoration activities. In this sense, the policyholders not only protect their own assets but also contribute to broader environmental and societal benefits, thus reducing the possibility of natural mishaps.

- **Private sector funding**

Institutions such as the Blue Natural Capital Financing Facility (BNCFF),[48] the Blue Carbon Accelerator Fund (BCAF),[49] and other incubators and accelerator programmes have been attempting to develop a business case for mangrove restoration and other NBS projects by engaging private players. Till 2021, public and private financial flows to NBSs were estimated to be US$154 billion per year.[50] Public funds make up 83 percent of the total, directing US$126 billion per year towards NBSs through government expenditure and US$2 billion per year through Official Development Assistance (ODA).[51] The private sector contributes approximately 17 percent at US$26 billion per year.

Financing Pathways

Despite their potential, mangroves face a funding gap. At the root of this under-investment is the market's failure to value the critical ecosystem services provided by mangroves. This can be mitigated in the following ways.

- **Making a business case out of mangrove conservation**

To attract viable investments, it is critical to incentivise the private sector, i.e., make a business case out of the preservation of mangrove ecosystems. Companies and business enterprises are less inclined to invest in social infrastructure and ecosystem development due to low RoI. Most of these companies view RoI from a business rather than social perspective. However, businesses are gradually recognising the significance of sustainability.[52] This, in turn, helps them maximise their market positioning and branding. Investing in natural capital offers opportunities to achieve both profit and purpose by aligning financial incentives with environmental and social objectives. Leveraging the social rate of return can drive positive environmental outcomes, promote sustainable development, and create value for investors, communities, and ecosystems.

It is important for business enterprises, the private sector, and corporations to recognise that they are intrinsically dependent on the ecosystem, or 'natural capital', for their sustenance, making them part of the social-ecological milieu. This phenomenon can be viewed through the lens of Porter and Kramer's notion of creating shared value (CSV)—a point of convergence between a business and society for generating economic value that reaps benefits for both entities.[53,54] Utilising this method of shared value can help create linkages between profit and societal prosperity.

- **Blended finance**

Blended finance can remove conflict and contestation for land resources. This includes blending private capital with public finance as well as merging climate finance with disaster management finance towards mangrove conservation efforts.

- **Mirroring best practices from local communities**

Integrating the format of the aquaculture of mangroves by involving local communities such as the farmers can aid in leveraging their income and contributing towards the protection of mangroves. This can also be achieved by bolstering plantation efforts. For instance, Indonesia has highlighted a plan to plant 600,000 hectares of mangroves by 2025.[55]

- **Boosting South-South cooperation in biodiversity conservation**

South-South cooperation is premised on shared experience, capacity, and resource constraints, as well as mutual respect. Lower-income economies face multifaceted and interconnected challenges—from widespread food insecurity and poverty, rising inequality, to corruption—the form and consequences of which often differ from those faced by economies of the Global North. Indeed, at times, these challenges are a result of the actions of those developed countries. For example, the current global economic system is characterised by many multinational corporations headquartered in the Global North but which continue to exploit resources and labour from countries in the Global South, often with little regard for local environmental and social impacts. This has further perpetuated the economic and social inequalities between these two economies. In this context, South-South cooperation can help countries foster alliances in a way that is mutually beneficial rather than exploitative.[56]

The United Nations Office for South-South Cooperation (UNOSSC) envisions that such partnerships can allow greater participation in global governance and decision-making from the Least Developed Countries (LDCs) and the Small Island Developing States (SIDS). Despite the geopolitical undercurrents between nations, South-South cooperation can enable new sources of development finance, in the form of concessional loans and untied grants, to flow between countries. The UN-sponsored SDG Fund aims to enable South-South cooperation to transform how knowledge is produced, policy is designed, and funding is secured.

- **Sustaining just and equitable North-South partnerships**

To attain the SDGs, the Global South and Global North will need to work together. However, these partnerships need to be forged on mutual terms and on equal footing, through various cooperation models that are hinged on a fair division of responsibilities. The unjust and exploitative nature of current development relationships need to be rectified and the objectives of development efforts realigned to meet the preferences and needs of lower-income countries. The priorities of multilateral development banks, including the International Monetary Fund (IMF) and the World Bank, are shaped by majority shareholders of the Global North and often do not align with the needs or preferences of countries receiving the financing. The African Development Bank has committed to phasing out projects that depend on the use of coal; the European Investment Bank has declared the same for fossil fuel use. The Asian Development Bank, for its part, supports knowledge, capacity-building, and SDG-related dialogues, though these commitments are yet to translate to better living conditions for the 1.2 billion who were living in acute multidimensional poverty in 2022.

- **Philanthropy as development finance**

Of the estimated US$4 billion investment needed by 2030 for mangrove conservation and restoration, approximately one-third, or US$1.2 billion, could come from commercial sources, such as private investors, businesses, or financial institutions.[57] Moreover, the global total net private wealth is pegged at US$454.4 trillion by the end of 2022, a figure that is expected to further rise by 38 percent and touch US$629 trillion by 2027.[58] In this sense, if philanthropy is able to direct even 0.0003 percent of this wealth, there could be better financing for mangrove conservation and restoration.

- **Financing climate adaptation and mitigation**

Traditional financing mechanisms are increasingly seeking pathways for mitigation such as just transition, renewable energy, switching to a low-carbon economy, waste management, and recycling. On the other hand, there has been less attention on adaptation measures such as biodiversity conservation, capacity building, skill development, and climate resilient infrastructure. Although Global North economies are discussing the need for energy transition to meet net-zero targets, countries of the Global South understand the importance of addressing the equity concerns of inclusiveness and fairness, which will provide access to resources for all. Moreover, the adaptation needs of the Global South are greater than those of the Global North.

- **Creating market mechanisms such as PESs for financing mangrove protection**

Market mechanisms, which allow downstream beneficiaries of mangrove ecosystems to make payments for the ecosystem services of mangroves, have also been advocated as one of the ways to finance mangrove conservation. Such schemes, described as Payments for Ecosystem Services (PES) and entailing mechanisms like Reducing Emissions from Deforestation and Forest Degradation (REDD+), have been successful in select cases for financing conservation, although their success in the case of mangroves is yet to be examined. Several challenges need to be overcome in order for PES schemes to work for the mangrove ecosystem.[59] First is the challenges concerning the quantification of the multiple ecosystem services, especially regulating services, such as wave diminution and coastal erosion control. Second, there are concerns about the sustainability of quantified ecosystem services given the fact that mangroves thrive on dynamic coastal zones that face multiple threats beyond the control of a PES site manager. While these require better financial risk management and hedging strategies, they are hardly within the scope of a coastal PES, which creates various management challenges. Third, any PES scheme necessitates the clear identification of ecosystem managers and beneficiaries of the ecosystem service; in the case of the mangroves, these may coincide. Fourth, the concern of valuing the ecosystem service persists, and the challenge of emerging with the robust and correct valuation framework needs to be confronted.

Conclusion

The proper valuation of mangroves and financing their protection and conservation requires addressing the ongoing debate between a weak environmental sustainability approach and a strong sustainability perspective. The popularity of the former stems from an optimistic view of sustainable development indicators such as “inclusive wealth”, “the new wealth of nations”, and the ecosystem services value accounts which are being pushed by the European Union, the United Nations, and the World Bank.

Meanwhile, proponents of the strong sustainability approach advocate for embedding the economy in biophysical processes and underline the importance of social factors without getting too involved in ontological reductionism.[60] Although natural capital is difficult to substitute, empirical studies show that the substitutability of natural capital with other forms of capital is low to moderate, at best. Devising a strong sustainability approach relies mainly on three factors: no a-priori substitutability, multidimensional analysis of social and geographical factors, and need for a social construction.

To develop a strong sustainability baseline for the conservation of ecosystems like the mangroves, substitution would not be a best-case scenario. However, understanding the social, environmental, and geographical factors of a particular region can contribute to its long-term preservation. The case for financing mangroves emerges from both sustainability and irreplaceable ecosystem services perspectives.

Yet, the challenge remains, as mangroves, which are a natural infrastructure, have the characteristics of public goods, similar to physical infrastructure. Further, due to a lack of market-discovered prices and values, their economic rate of return is not perceptible unless the valuation of their ecosystem services is made imperative. However, their long-run social rate of return is steep. In this context, what can make sources of financing more interested in mangroves? For this to be possible, either fiscal incentives or institutional mechanisms need to be implemented in order to create processes for various players to address the sustainability concern and help equate the social rate of return with the long-run economic rate of return.ORF

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